

## **CLAIMS LISTING**

**1. (Currently Amended)** A method for investigating messages passed in a message-passing environment, the method comprising:

collecting message traces from at least one participant in the message-passing environment, wherein each message trace is a series of messages originating from or sent to the at least one participant, ordered by time, wherein each message has a first piece describing transfer of information and a second piece describing an operation being performed in the message;

converting identifying information pertaining to the at least one participant into an indication of a role played by the at least one participant in the message-passing environment;

assembling the messages into at least one message sequence, wherein assembling includes combining multiple message traces into the at least one message sequence, each message trace pertaining to one or more messages transmitted by, or received at, a participant, wherein the combining is based on one or more of, a specified participant, a specified time frame, a transaction nature and the role played by the at least one participant;

analyzing the at least one message sequence from the message-passing environment to extract information regarding the at least one participant in the message-passing environment, wherein the analyzing comprises comparing at least one message sequence with a reference message sequence, the reference

message sequence comprises at least one of a sequence that reflects an error-free operation in the message passing environment and a sequence that reflects known failure conditions in the message passing environment;

performing cluster analysis to group the at least one message sequence into at least one cluster, wherein the cluster analysis includes forming a data matrix based on information in the at least one message sequence and forming the at least one cluster based on the data matrix, at least one cluster includes the reference sequence;

sorting into a ranked order at least two clusters based on a number of members associated with each cluster, the sorting prioritized from least members to most members associated each of the at least two clusters; and

outputting the information into a table format based on the sorting into a ranked order, each cluster represented in the table format is linked to information regarding an associated message sequence.

**2. (Original)** The method according to claim 1, wherein the message-passing environment is a network environment including plural participants coupled together via a network.

**3. (Original)** The method according to claim 2, wherein the network uses an Internet Protocol to transmit messages between participants.

**4. (Original)** The method according to claim 2, wherein the messages express the information in one of a plurality of message formats.

**5. (Original)** The method according to claim 2, wherein the messages include information expressed in a markup language.

**6. (Original)** The method according to claim 5, wherein the markup language is the extensible markup language (XML).

**7. (Original)** The method according to claim 2, wherein the network uses Simple Object Access Protocol (SOAP) to transmit messages between participants.

**8. (Original)** The method according to claim 1, wherein the message-passing environment is a machine or system including plural interacting components that function as message participants.

**9. (Original)** The method according to claim 1, wherein the message-passing environment is a software program including plural interacting software modules that function as message participants.

**10. and 11. (Canceled)**

**12. (Original)** The method according to claim 1, wherein the assembling comprises assembling plural message sequences, and the analyzing comprises analyzing the plural message sequences.

**13. and 14. (Canceled)**

**15. (Previously Presented)** The method according to claim 1, wherein the forming of the data matrix involves extracting features from said at least one message sequence, including extracting numerical counts for at least one feature present in the message sequence, the feature including at least one of: a message command type, a sender/receiver pair, a property of the message and an application-level property.

**16. (Currently Amended)** The method according to claim 1, wherein the forming of the data matrix involves forming a similarity measure which measures the difference between said at least one message sequence and another message sequence, wherein forming a similarity measure includes ~~at least one of:~~ string/sequence matching and comparing said at least one message sequence with an optimal functioning sequence, a good server trace, a bad server trace, and a known sequence from an alternate message-passing environment.

**17. (Previously Presented)** The method according to claim 1, wherein the analyzing involves identifying results of the cluster analysis that may warrant further investigation, wherein the identifying includes comparing the at least one message sequence against a formal model of the message passing environment and placing the at least one message sequence into one or more clusters representing adherence to the formal model, non-adherence to the formal model and “interesting”, wherein “interesting” includes indicia of beneficial phenomena, anomalous conditions, and other features which cause the at least one message sequence to be singled out from other message sequences.

**18. (Canceled)**

**19. (Original)** A computer readable medium including machine readable instructions for implementing the collecting, assembling, analyzing, and outputting recited in claim 1.

**20. (Currently Amended)** An apparatus for investigating messages passed in a message-passing environment, the apparatus comprising:

message aggregation logic configured to collect a plurality of messages from at least one participant in the message-passing environment, and to assemble the messages into at least one message sequence, wherein each

message has a first piece describing transfer information and a second piece describing an operation being performed in the message;

analysis logic configured to analyze said at least one message sequence from the message passing environment to extract information regarding at least the one participant in the message-passing environment, wherein the analysis logic is further configured to compare said at least one message sequence with a reference message sequence, the reference message sequence comprising a sequence that reflects an error-free operation in the message passing environment;

cluster analysis logic configured to perform cluster analysis to group the at least one message sequence and the reference message sequence into at least one cluster, wherein the cluster analysis logic is configured to form a data matrix based on information in the at least one message sequence and form the at least one cluster based on the data matrix, the cluster analysis logic is configured to measure a distance between two or more message sequences of each cluster formed by the cluster analysis logic; and

output logic configured to output the information as a two-dimensional presentation of the at least one cluster and indicating the reference sequence and the distance associated with the at least one message sequence.

**21. (Original)** The apparatus according to claim 20, wherein the message-passing environment is a network environment including plural participants coupled together via a network.

**22. (Original)** The apparatus according to claim 21, wherein the network uses an Internet Protocol to transmit messages between participants.

**23. (Original)** The apparatus according to claim 21, wherein the messages express the information in one of a plurality of message formats.

**24. (Original)** The apparatus according to claim 21, wherein the messages include information expressed in a markup language.

**25. (Previously Presented)** The method according to claim 24, wherein the markup language is the extensible markup language (XML).

**26. (Original)** The apparatus according to claim 21, wherein the network uses Simple Object Access Protocol (SOAP) to transmit messages between participants.

**27. (Original)** The apparatus according to claim 20, wherein the message-passing environment is a machine or system including plural interacting components that function as message participants.

**28. (Original)** The apparatus according to claim 20, wherein the message-passing environment is a software program including plural interacting software modules that function as message participants.

**29. (Original)** The apparatus according to claim 20, wherein the message aggregation logic is further configured to convert identifying information pertaining to said at least one participant into an indication of a role played by the participant in the message-passing environment.

**30. (Original)** The apparatus according to claim 20, wherein the message aggregation logic is further configured to combine multiple message traces into said at least one message sequence, each message trace pertaining to one or more messages transmitted by and/or received at a participant.

**31. (Original)** The apparatus according to claim 20, wherein the message aggregation logic is further configured to assemble plural message sequences, and the analysis logic is further configured to analyze the plural message sequences.



**32. and 33. (Canceled)**

**34. (Previously Presented)** The apparatus according to claim 20, wherein the analysis logic is configured to form the data matrix by extracting features from said at least one message sequence.

**35. (Previously Presented)** The apparatus according to claim 20, wherein the analysis logic is configured to form the data matrix by forming a similarity measure which measures the difference between said at least one message sequence and another message sequence.

**36. (Previously Presented)** The apparatus according to claim 20, wherein the analysis logic is further configured to identify results of the cluster analysis that may warrant further investigation.

**37. (Canceled)**

**38. (Original)** A computer readable medium including machine readable instructions for implementing the message aggregation logic, the analysis logic, and the output logic of claim 20.

**39. (Currently Amended)** An apparatus for investigating messages passed in a message-passing environment, the apparatus comprising:

means for collecting message traces from at least one participant in the message-passing environment, wherein each message trace is a series of messages originating from or sent to the at least one participant, ordered by time, wherein each message has a first piece describing transfer of information and a second piece describing an operation being performed in the message;

means for converting identifying information pertaining to the at least one participant into an indication of a role played by the at least one participant in the message-passing environment;

means for assembling the messages into at least one message sequence, wherein assembling includes combining multiple message traces into the at least one message sequence, each message trace pertaining to one or more messages transmitted by, or received at, a participant, wherein the combining is based on one or more of, a specified participant, a specified time frame, a transaction nature and the role played by the at least one participant;

means for analyzing the at least one message sequence from the message-passing environment to extract information regarding the at least one participant in the message-passing environment, wherein the analyzing comprises comparing at least one message sequence with a reference message sequence, the reference message sequence comprises at least one of a sequence that reflects an error-free operation in the message passing

environment and a sequence that reflects known failure conditions in the message passing environment;

means for performing cluster analysis to group the at least one message sequence and the reference message sequence into at least one cluster, wherein the cluster analysis includes forming a data matrix based on information in the at least one message sequence and forming the at least one cluster based on the data matrix;

means for storing the at least one message in a master collection of message sequences;

means for culling the master collection of message sequences for at least one subset of a message sequence based on specified criteria including one ~~[[of]]~~ or more of: a specified time range, transaction type, participants involved in at least one message exchange, objectives of an analyst and a nature of the message-passing environment involved; and

means for storing the at least one subset for subsequent analysis; and

means for outputting the information.

#### **40. (Canceled)**

**41. (Previously Presented)** The apparatus according to claim 20, wherein the reference message sequence is a sequence that reflects known failure conditions within the message passing environment.